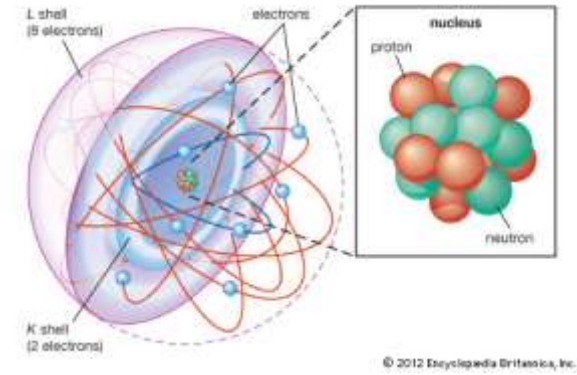
Bell Work
2-Oct-17

Using your knowledge of matter, how would YOU describe an atom?
Give at least three (3) specific points for your description. In addition you may draw what you think an atom looks like.

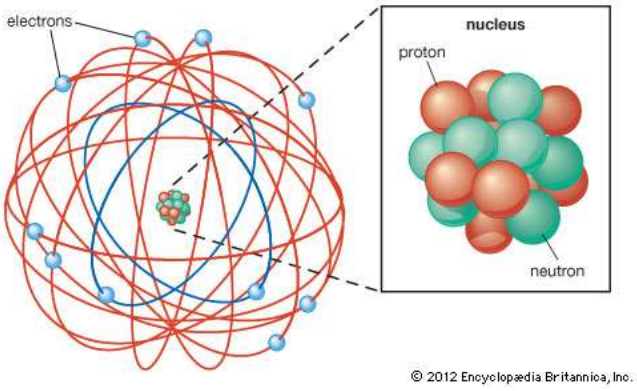
EQ: How could a conception of interactions between atoms help further your understanding of our universe?

OBJECTIVES:

- Observe presences of a negatively charges subatomic particle
- Size up an atom



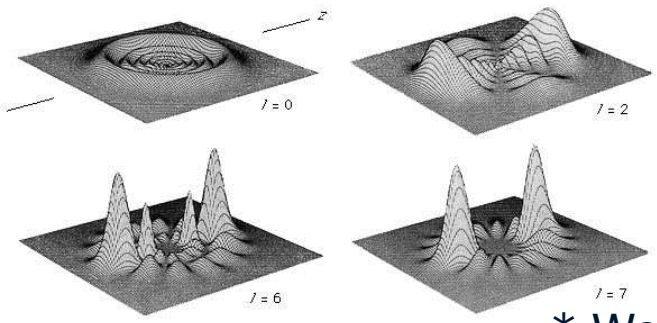
Bell Work 4-Oct-2017

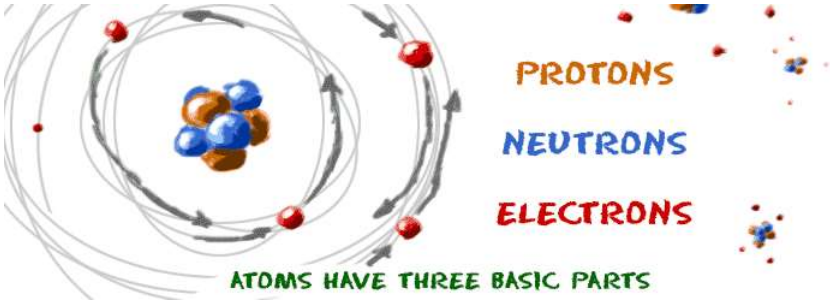


What are the three (3) subatomic particles that make up an atom and where are they found?

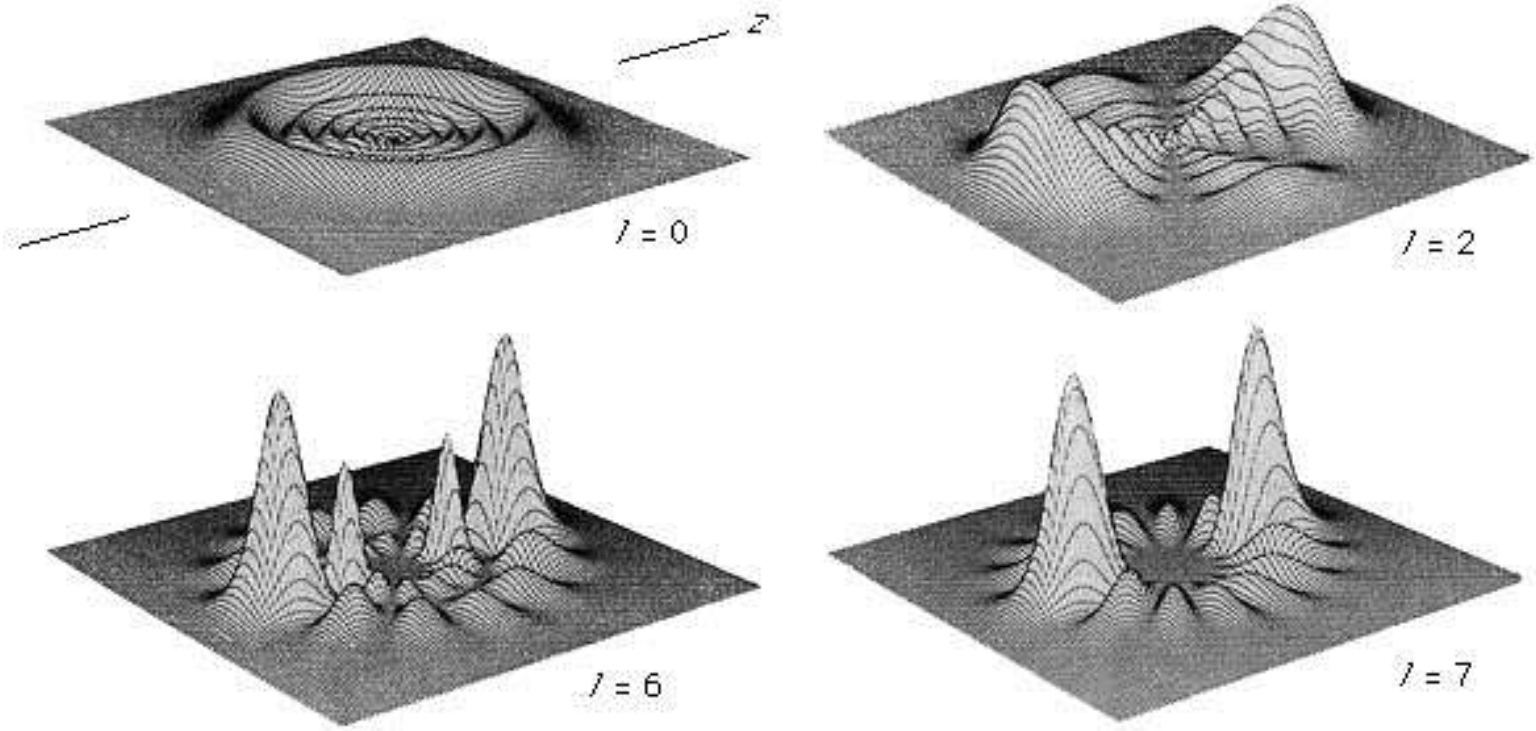
Where is the all* the mass of an atom?

Volume?





* We are assuming 100% but it really is just under 100%



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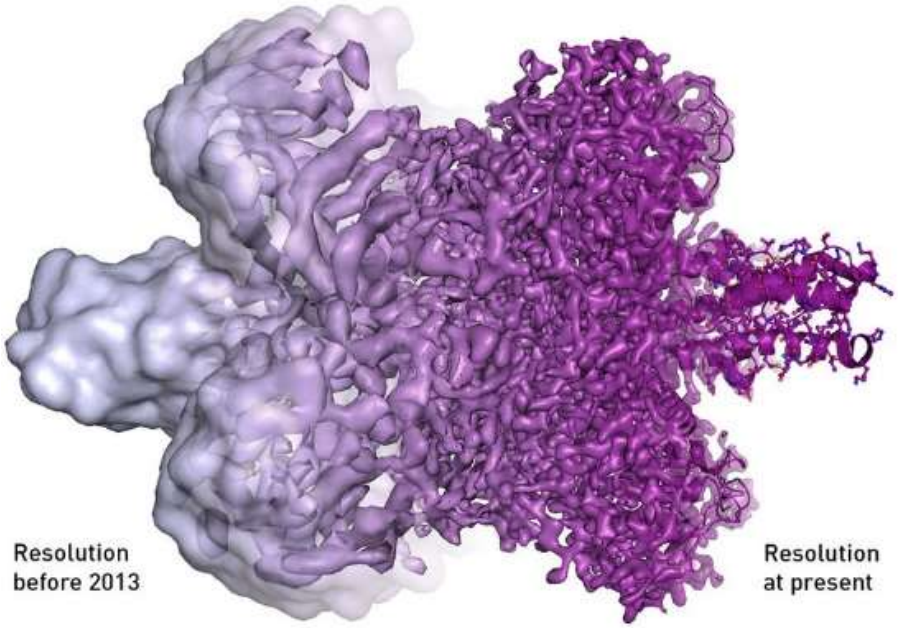
Nobel in Chemistry 2017

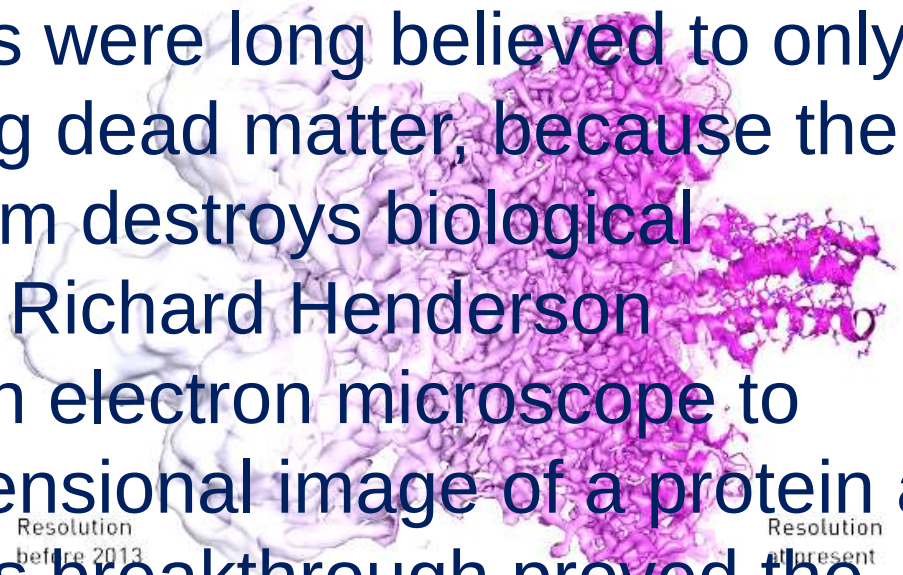
cryo-electron microscopy
Cryoelctrospcopy = "freezing" a molecule so a bunch of 2D images from an electron microscope can be combined into a detailed 3D picture



https://youtu.be/Excci0_it3o

Nobel in Chemistry 2017

"Electron microscopes were long believed to only be suitable for imaging dead matter, because the powerful electron beam destroys biological material. But in 1990, Richard Henderson succeeded in using an electron microscope to generate a three-dimensional image of a protein at atomic resolution. This breakthrough proved the technology's potential.



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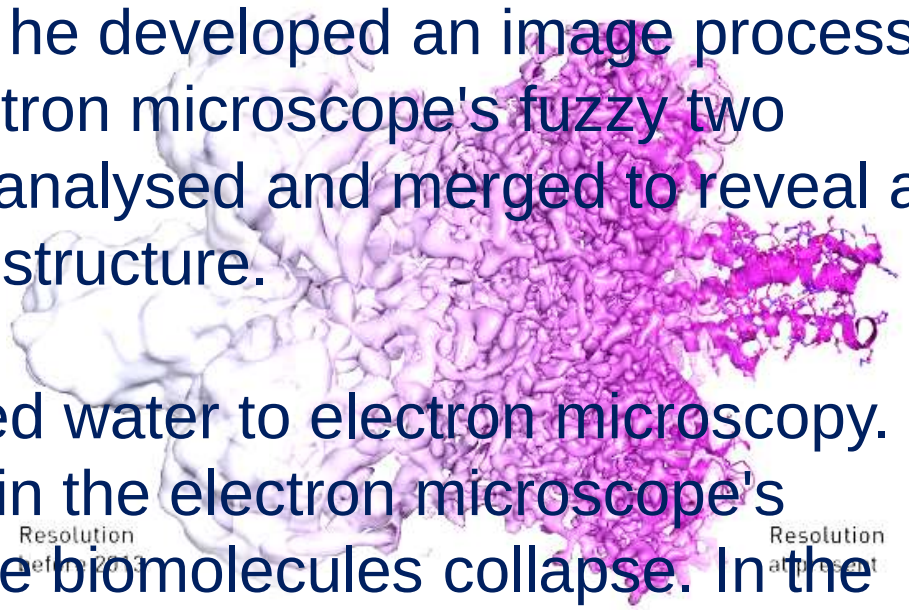
Nobel in Chemistry 2017

"Joachim Frank made the technology generally applicable. Between 1975 and 1986 he developed an image processing method in which the electron microscope's fuzzy two dimensional images are analysed and merged to reveal a sharp three-dimensional structure.



"Jacques Dubochet added water to electron microscopy. Liquid water evaporates in the electron microscope's vacuum, which makes the biomolecules collapse. In the early 1980s, Dubochet succeeded in vitrifying water – he cooled water so rapidly that it solidified in its liquid form around a biological sample, allowing the biomolecules to retain their natural shape even in a vacuum."

https://youtu.be/Excci0_it3o

*A thought on the atom & our universe by **Neil deGrasse Tyson***

The most astounding fact

http://youtu.be/9D05ej8u-gU

Defining the Atom

The Greek philosopher Democritus was among the first to suggest the existence of atoms (from the Greek word "atomos")

- **He believed that atoms were *indivisible* and *indestructible***
- **His ideas did agree with later scientific theory, but did not explain chemical behavior, and was *not based on the scientific method* – but just philosophy**

Recall…

What is the scientific method?

List the part and them describe.

The Scientific Method

Ask a question

Research the Question

Form a hypothesis

Test hypothesis through an experiment

Analyze data and form a conclusion

Communicate your results

Dalton's Atomic Theory (experiment based!)

1. Elements are composed of tiny indivisible particles called atoms

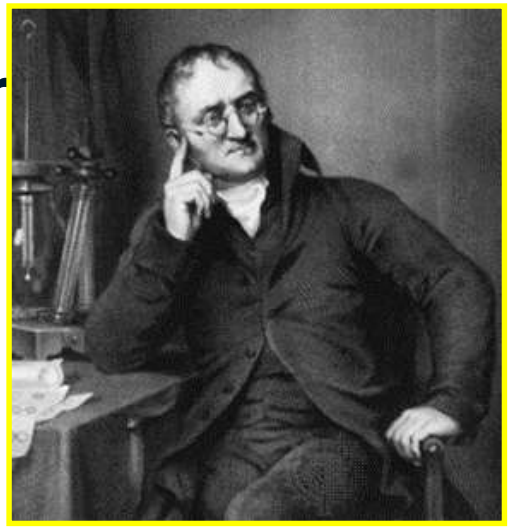
John Dalton
(1766 – 1844)

2. Atoms of the same element are identical. Atoms of any one element are different from those of any other element.

Dalton's Atomic Theory (experiment based!)

3. Atoms of different elements combine in simple whole-number ratios to form chemical compounds

4. In chemical rxns, atoms are combined, separated, or rearranged – but never changed into atoms of another element.



John Dalton (1766 – 1844)

Structure of the Nuclear Atom

One change to Dalton's atomic theory is that <u>atoms are divisible</u> into subatomic particles:

Electrons (e^-),

protons (p^+),

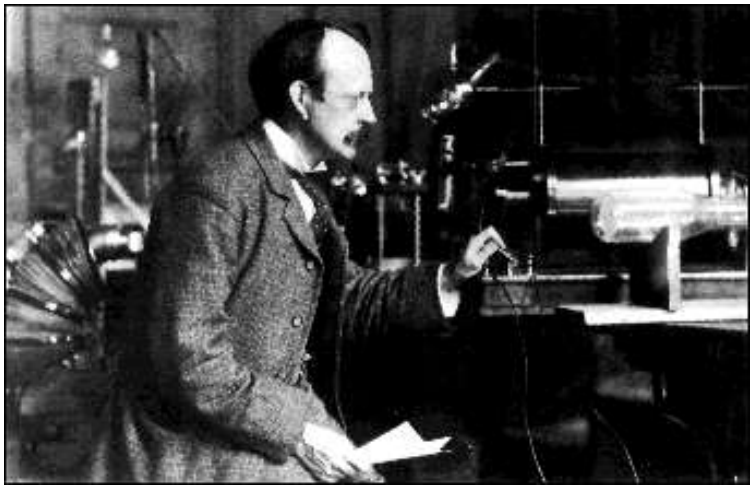
neutrons(n^0)

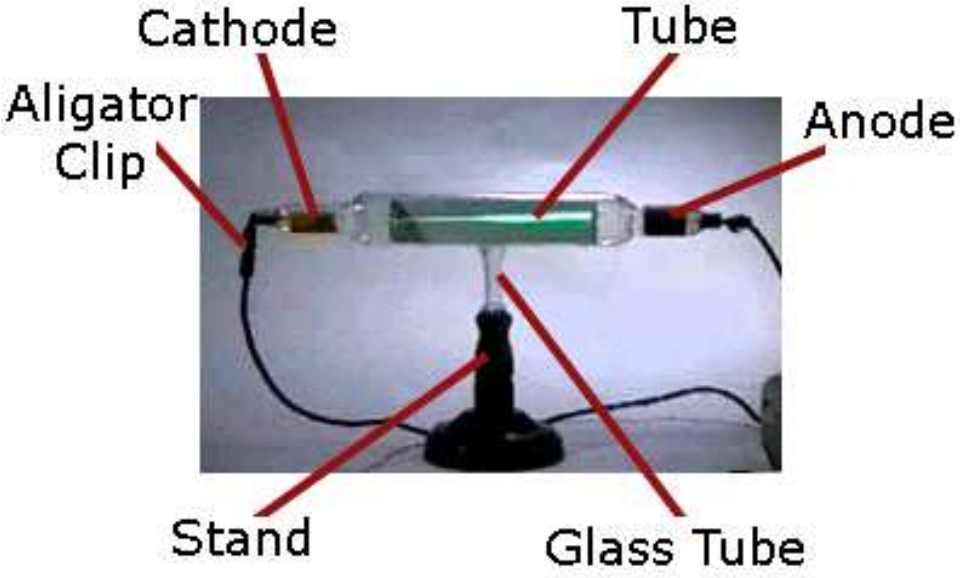
are examples of these fundamental particles

There are many other types of particles, but we will study these three (3)

Discovery of the Electron (e^-)

In 1897, J.J. Thomson used a *cathode ray tube* to deduce the presence of a negatively charged particle: the electron (e^-)





Modern Cathode Ray Tubes

Television

Computer Monitor

Cathode ray tubes pass electricity through a gas that is contained at a very low pressure.

Mass of the Electron

The oil drop apparatus

Mass of the electron is 9.11×10^{-28} g

1916 – Robert Millikan determines the mass of the electron: 1/1840 the mass of a hydrogen atom; has one unit of negative charge

http://youtu.be/XMfYHag7Liw

Conclusions from the Study of the Electron:

A) Cathode rays have identical properties regardless of the gas (element) used . All elements must contain identically charged e^-.

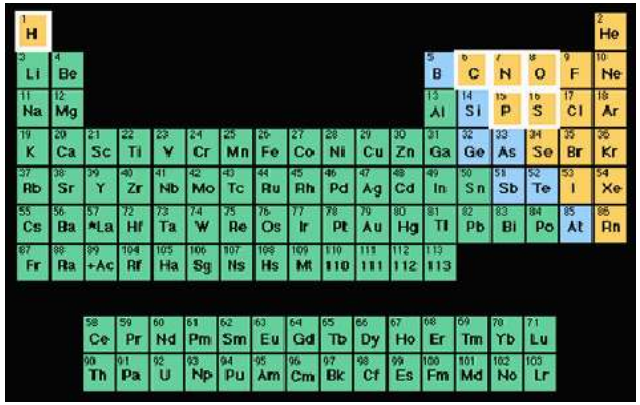
B) Atoms are neutral, so there must be <u>positive particles</u> in the atom to balance the negative charge of the e^-

$(p^+) + (e^-)$ = Charge

Conclusions from the Study of the Electron:

c) **<u>Electrons have so little mass</u> that atoms must contain other particles that account for most of the mass**

Sizing up the Atom

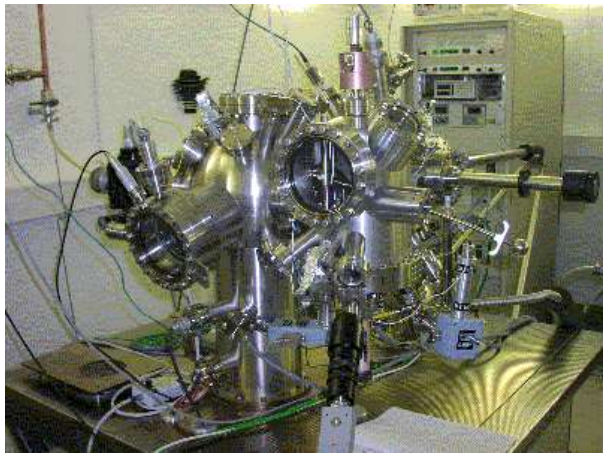


<u>Elements are able to be subdivided</u> into smaller and smaller particles – these are the *atoms*, and they still have properties of that element

Sizing up the Atom

If you could line up 100 000 000 Cu atoms in a single file, they would be approximately *1cm long*

Despite their <u>small size</u>, individual atoms are observable with instruments such as *scanning tunneling (electron) microscopes (SEM)*



Size of the Atom

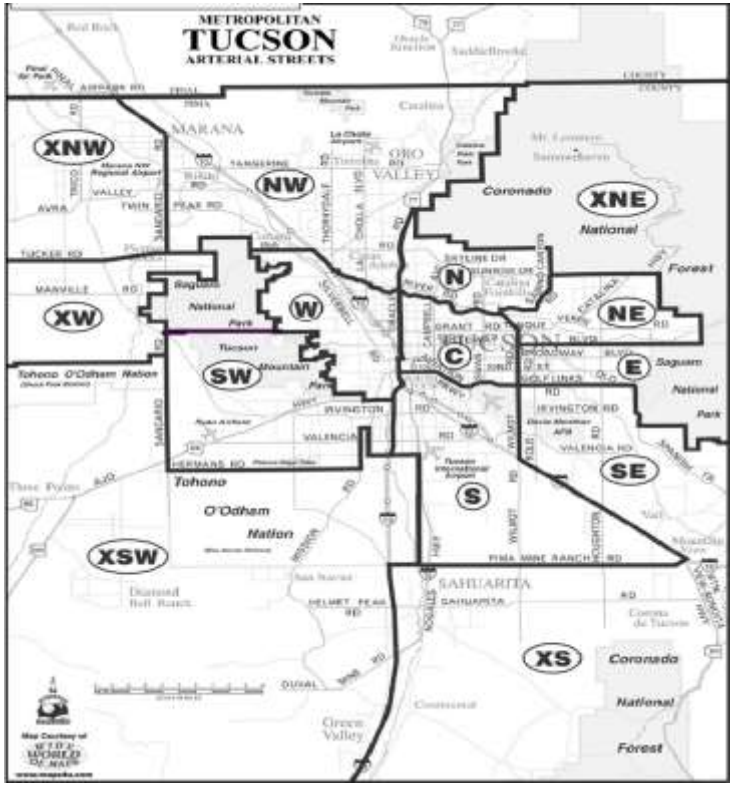
If the diameter of an atom is 100 000x larger than the diameter of its nucleus, what is the diameter, in meters, of an atom that has a nucleus **0.1cm** in diameter?

How to really see this

We are going to the field to look at the size of the electron cloud compared to the nucleus!

Mapping atomic structure

You will use a string and a meter stick to determine the diameter of one of four (4) different balls.



1.61 km = 1.00 mile

Then you will relate the diameter to the size of a nucleus and draw it on the map of Tucson.

Turn In
4-Oct-2017

Physical and Chemical changes Lab

Bell Work
5-Oct-2017

What experiment was used to determine the presence of the electron?

Explain/ Describe in detail the apparatus used?

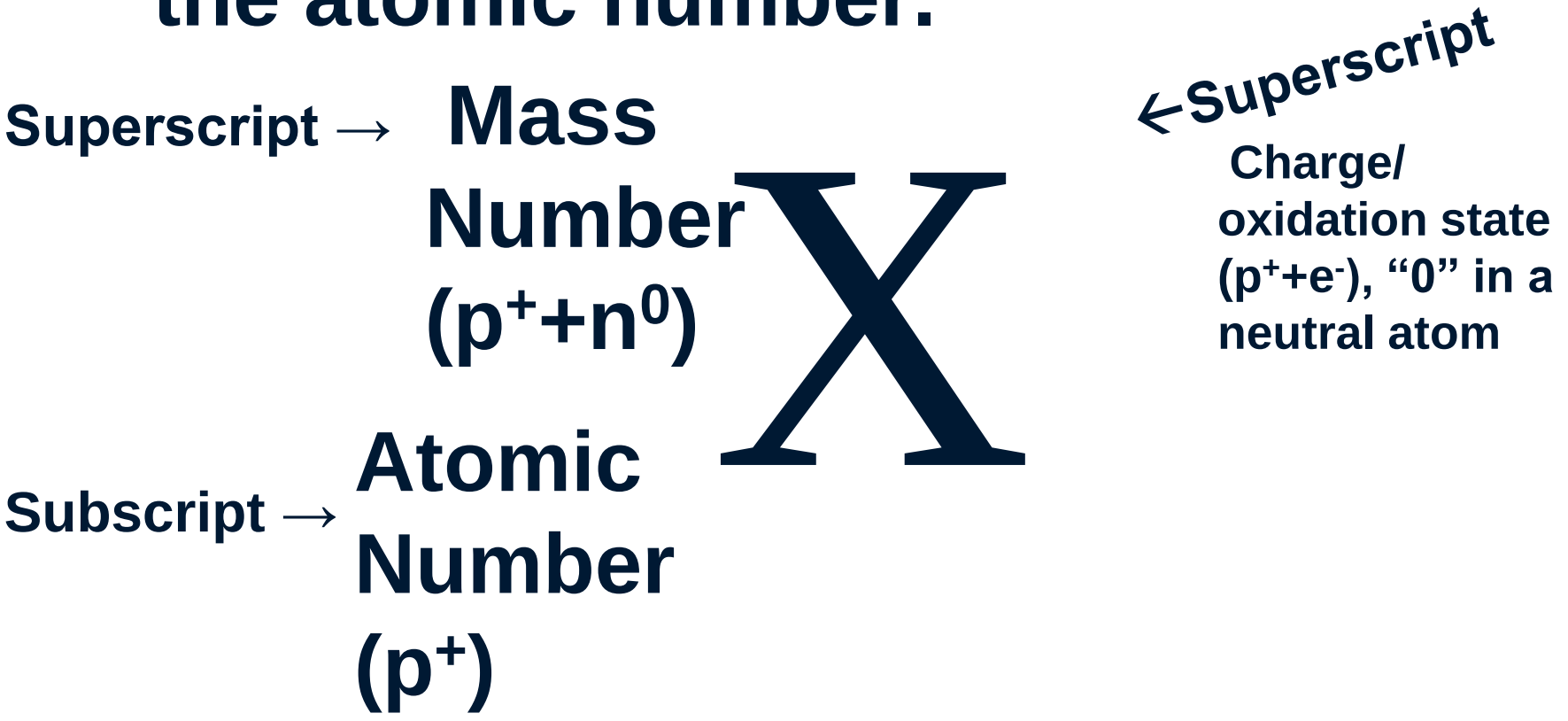
EQ: When have you put enough effort into a task you know is vital toward your success?

OBJECTIVES:

You will explore how average atomic mass is calculated through a simulation.

Atomic Complete Symbols

Contain the symbol of the element, the mass number and the atomic number.



Biennium Lab

Don’t lose the isotope or mix them up

Beanium and Recall

What should you not drop on the floor?

Where can you find a formula for each of the calculations?

What part of an atoms weight can very it's mass, what part must say constant to still be that atom?

EQ: When have you put enough effort into a task you know is vital toward your success?

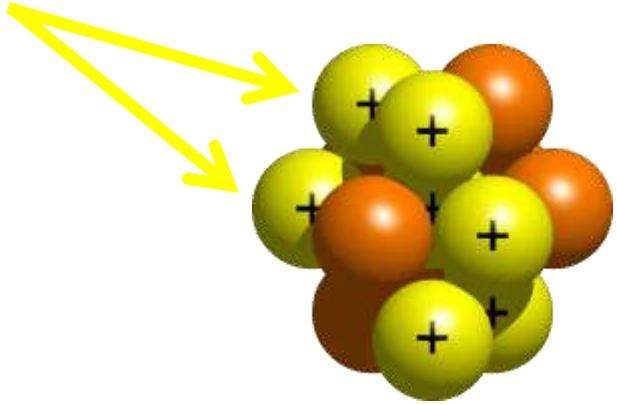
OBJECTIVES:

- Explain where the mass of an atom and the bulk of the volume are located in an atom
- See relative size of an atom: nucleolus

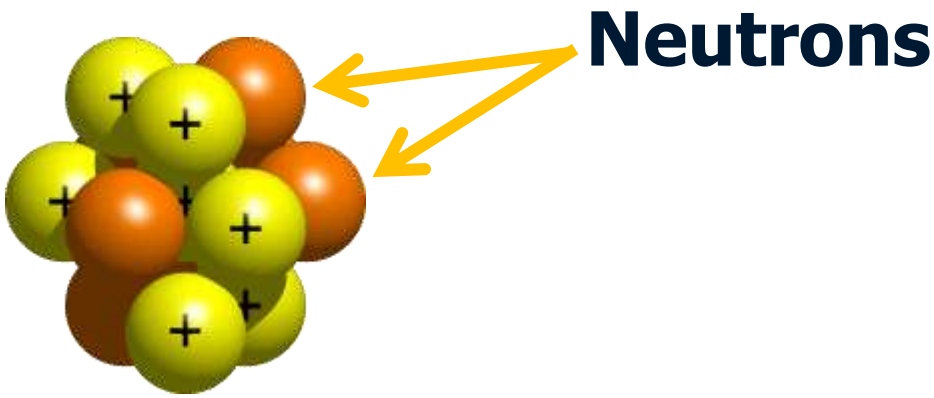
Conclusions from the Study of the Electron:

Eugen Goldstein in 1886 observed what is now called the "<u>proton</u>"(p^+). Particles with a positive charge, and a relative mass of 1 (or 1840 times that of an e^-).

Protons



Conclusions from the Study of the Electron:



1932 – James Chadwick confirmed the existence of the "neutron" – a particle with no charge, but a mass nearly equal to a proton